

Consistent with the U.S. commitment to the defense of NATO, the Army deploys in Europe four divisions, four brigades, and two armored cavalry regiments. (Three of these four brigades are affiliated with active-duty divisions in the continental United States.) Including support forces, there are about 215,000 active Army troops in Europe. Should war erupt in Europe, those units would be reinforced by 11 active-duty and eight National Guard divisions, as well as separate brigades and armored cavalry regiments coming from the continental United States.

Ground Force Materiels

Ten of the Army's divisions and some of the separate brigades are armored or mechanized infantry units (see Appendix A). These units have the majority of tanks and other heavy equipment and will receive most of the new fighting equipment under the modernization program. Though few reserve units will receive new equipment purchased under the modernization program, they will receive the equipment that is replaced in the active units and will thus gain from force modernization.

Several major types of combat equipment are contained in a U.S. armored division. For example, the weapons and tracked combat vehicles include approximately 360 tanks, 500 armored personnel carriers, 108 antitank missiles mounted on vehicles, 24 air defense guns, and 66 pieces of self-propelled artillery (the latter consists of 54 self-propelled 155-millimeter howitzers and 12 self-propelled eight-inch howitzers). The aviation assets of an armored division include 42 attack helicopters, 56 scout/observation helicopters, and 45 transport helicopters. A mechanized infantry division contains all of the same types of combat equipment as an armored division. The quantities of weapons and tracked combat vehicles differ, however. For example, a mechanized infantry division contains 306 tanks, 570 armored personnel carriers, and 126 antitank missiles mounted on vehicles.

ORGANIZATION OF NATO FORCES

The U.S. Army would not, of course, be alone in defending the Central Region of Europe. Some 980,000 active ground forces and more than 900,000 reserves from other NATO nations would join them in combat. The organization of NATO's defensive forces are shown in Figure 1.

The areas of responsibility of NATO's Central Region are defined by two Army groups, each of which is subdivided into four corps sections. Each corps section consists of at least two divisions. In the Northern Army Group (NORTHAG), Belgium, the Federal Republic of Germany (West Germany), Great Britain, and the Netherlands each contribute a corps-sized force. The Central Army Group (CENTAG) is composed of two West German and two U.S. corps. Though not assuming responsibility for the

Figure 1.
Corps Sectors of Military Responsibility in NATO's Central Region



SOURCE: Adapted by CBO from Richard Lawrence and Jeffrey Record, *U.S. Force Structure in NATO* (Washington, D.C.: Brookings Institution, 1974), p. 31 and also from U.S. Army materials.

NOTE: NORTHAG (Northern Army Group) and CENTAG (Central Army Group) are the two subdivisions of NATO forces in West Germany. The line dividing the two runs from Belgium through West Germany, just south of Bonn, and into East Germany.

defense of any individual corps section, the other NATO members (such as Luxembourg and Canada) could contribute forces as part of NATO's strategic reserve or in defense of their national borders against a Pact attack. (In other words, Danish forces would defend Denmark.) France would presumably contribute forces as well, even though it is not a participant in NATO's military council, because it maintains three armored divisions in West Germany.

In the event of war, the divisions stationed in NORTHAG and CENTAG would be reinforced by units coming from the various NATO member nations' home bases. Of all NATO reinforcements, one-third would come from the United States; the Department of Defense has therefore implemented a program to speed the deployment of some of these reinforcements without actually stationing the requisite personnel abroad. This program, which provides storage for "prepositioned" military equipment in Europe for U.S.-based reinforcing units, is known as POMCUS (for Prepositioned Overseas Materiel Configured to Unit Sets). ^{4/} At present, enough equipment--four "division sets"--is prepositioned in Europe to support speedy deployment of four U.S. Army divisions. As part of a commitment to strengthen NATO, the Administration plans to increase to six the number of divisions with equipment prepositioned there. The initiative to enhance allied reinforcement capabilities--by expanding the number of division sets in POMCUS--is a part of the Long-Term Defense Program (LTDP) agreed to in 1978 by the NATO allies. ^{5/}

PROSPECTS FOR NATO FORCE MODERNIZATION UNDER FISCAL PRESSURES

As it is now designed, the Army's current modernization program would spend about \$46 billion over the next five years. Purchases of many of the proposed new systems are already under way. (Data for procurement of some of the systems therefore date back to 1979.) Since "buys" of some systems will continue well beyond the next five years, the eventual commitment of resources will ultimately far exceed \$46 billion.

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4. For more information on the POMCUS program, see for example Congressional Budget Office, Strengthening NATO: POMCUS and Other Approaches (February 1979), and Costs of Prepositioning Additional Army Divisions in Europe (August 1980).
 5. The LTDP was formalized by NATO in 1978. Major initiatives include reinforcement as well as improvements in readiness, reserve mobilization, maritime posture, air defense, command and control, logistics, and theater nuclear modernization.

The Army may have trouble affording all of this program, however, and the Congress continues to show concern over the growth of both the procurement and operating costs of Army weapons. In enacting the First Concurrent Resolution on the Budget for Fiscal Year 1983, the Congress reduced the overall defense budget authority by about 4 percent, as part of a package of spending cuts and tax increases designed to reduce the federal deficit and improve the state of the U.S. economy. Further reductions are possible. Nor are budgetary problems in the United States the only factors that could affect modernization.

The Congress has expressed concern that the allies are not spending enough on defense. In response to perceived weaknesses in NATO's defense vis-a-vis the Warsaw Pact's, each NATO member agreed to seek 3 percent annual real growth in defense outlays over the five-year period 1978-1983. In May 1981, the NATO allies reaffirmed their commitment to meeting the 3 percent goal. Though some members had a measure of success in achieving this target, the additional expenditures have not readily translated into major improvements in NATO forces (see also Chapter 2).

Alternative Approaches for U.S. Modernization

In light of these concerns, this study analyzes the effects of two alternatives to the Army's modernization program that would reduce its cost. The first approach would lower costs by slowing the buys of major weapons systems, a course often taken in past years. The second would indefinitely defer purchase of a few weapons systems in order to continue buying others at rapid rates. The latter strategy would be more consistent with recent Defense Department initiatives that stress the need to buy weapons at economical rates.

Under some assumptions, however, both of these reduced programs would fail to give NATO the preponderance of forces that Army doctrine and defense policy suggest are needed. Indeed, even the Army's full modernization program would not provide adequate forces under these assumptions. Thus this study also evaluates the cost of speeding up the Army modernization program and of adding additional Army troops. These estimates provide a benchmark for judging the costs of meeting ground force requirements under militarily more pessimistic assumptions--even though these alternatives may be impracticable in this period of fiscal austerity.

PLAN OF THE STUDY

Chapter II details the Administration's modernization program; it also reviews efforts in other NATO countries and identifies assumptions about the programs in the Warsaw Pact. Chapter III analyzes the effects of these

programs on the force balance in Europe. On these bases, Chapter IV considers the costs and effects of alternative modernization programs.

This study focuses on procurement costs, but the Army may also face problems paying the bills to operate these new weapons. Though the Army's share of the total Defense Department budget has remained constant at about 24 percent, the proportion of Army money spent on investment (that is, procurement, research and development, and military construction) has risen from an annual average of 27 percent in the 1970s to almost 40 percent in the proposed 1983 budget. If reductions in defense spending are made in the operating accounts, this could make supporting new equipment adequately especially difficult. A full investigation of this problem is beyond the scope of this study, but Chapter V does estimate the operating costs of two of the most important new Army systems, the M1 tank and the Fighting Vehicle System. (A glossary, on the following pages, explains these and other terms used in this paper.)

GLOSSARY OF TERMS

Weapons in the current U.S. modernization program analysed in this paper:

M1 Tank. The Army's newest tank, the M1 will replace the current M60 series tank (built mostly in the late 1950s and early 1960s). The M1 is equipped with a 105-millimeter gun and incorporates special armor, a laser rangefinder, integrated sight, and a 1,500 horsepower turbine engine. The tank has been in production since fiscal year 1979, and fielding began in 1981. Future plans include the incorporation of a 120-millimeter main gun in the mid-1980s.

M2 Fighting Vehicle System. Also called the Bradley Fighting Vehicle, the FVS will replace the current M113 armored personnel carrier. The FVS has special armor and a thermal sight. The two-man turret mounts a 25-millimeter cannon and also carries a TOW (defined below) antitank guided missile. Initial production began in fiscal year 1980, and fielding is scheduled for early 1983.

Multiple Launch Rocket System. An artillery rocket system, the MLRS will complement cannon artillery. The MLRS is designed to counter enemy artillery or air defense. It can deliver 16 warheads that carry conventional submunitions. Procurement of MLRS began in fiscal year 1980, and current plans call for the fielding of the system in the early 1980s.

AH-64 Apache Helicopter. The Army's newest attack helicopter, the AH-64 will replace the current Cobra gunships that carry eight TOW (defined below) antitank missiles. It will be the Army's primary airborne antitank weapon and will permit a two-man crew to attack in darkness and in adverse weather. The primary armament on the AH-64 is 16 Hellfire antitank missiles (defined below), which can home in on a target designated by a laser beam. The AH-64 also carries a 30-millimeter chain gun and 2.75-inch rockets. Production began in fiscal year 1982, and fielding is scheduled for the mid-1980s.

Hellfire Missile. Designed to be carried on the AH-64 (see above), the Hellfire homes in on a target that has been designated by a laser

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beam; this designation can be done by other aircraft as well as by ground observers. Current plans call for a "follow-on seeker" that will permit the missile to find its target without any external designator--a "fire and forget" capability. The Hellfire is scheduled to be deployed with the AH-64.

Army Helicopter Improvement Program. Designed to modify the current OH 58 scout/observation helicopters that conduct reconnaissance and find targets, and direct attacks, the AHIP will provide both day and night capabilities. It will also increase the helicopter's operational capability. The AHIP currently is in development, and production is scheduled for fiscal year 1984.

Division Air Defense Gun. Designed to provide the Army's forward combat units with low-altitude air defense coverage, the DIVAD gun will replace the current Vulcan air defense gun. Whereas the Vulcan has a 20-millimeter gun with an effective range of two kilometers, the DIVAD is a twin 40-millimeter gun with an effective range of four kilometers. Production of the DIVAD began in fiscal year 1982, and the first systems are scheduled to be deployed in the mid-1980s.

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Other weapons:

Tube-Launched Optically-Tracked Wire-Guided (TOW) Antitank Missile. To be carried on the FV5 (see above), the Cobra Attack Helicopter, and the Improved TOW Vehicle, this missile's warhead can penetrate (from the front) the majority of the world's main battle tanks. It has an effective range of 3,000 meters. Once launched, it must be guided by a gunner, who maintains the crosshairs of the sight on the target. As the gunner tracks the target, a computer in the launcher sends corrections to the missile through fine wires. The TOW missile has been in the Army's inventory for many years; current plans call for improvements in the lethality of the warhead. A French-built equivalent of the TOW missile is the HOT--for Haut Subsonique Optique

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Teleguide Tire d'Un Tube--missile, which is standard equipment in the French and West German armies.

Leopard II Tanks. A specially armored tank, the Leopard II is the latest version of the West German main battle tank; it is to replace the current Leopard I tank. The Leopard II tank has a 120-millimeter main gun, an integrated laser rangefinder, and thermal image unit. Production began in 1979, and by 1982, the annual production rate is assumed to be 300 tanks.

T-80 Tank. The latest version of the Soviet (hence Warsaw Pact) main battle tank, the T-80, will replace the current T-72 built in the early 1970s and the T-64 built even earlier. The T-80 is believed to have a 125-millimeter main gun, an automatic loader, and laser rangefinder. A major improvement relative to the T-72 may be the tank's special armor.

BMP. A Soviet-built armored fighting vehicle, the BMP is equipped with a 73-millimeter automatic-loaded gun that will fire a High Explosive Anti-Tank (HEAT) round. The BMP has been in production since the late 1960s, and it is deployed in significant numbers in Warsaw Pact armies.

HIND E. A Soviet-built attack helicopter, the HIND E is equipped with a large caliber machine gun and 57-millimeter rockets. It is believed to have a "fire and forget" missile with a range of eight kilometers. The HIND armed helicopter has been deployed since 1974 in Warsaw Pact armies.

CHAPTER II. ARMY MODERNIZATION IN PERSPECTIVE

The Warsaw Pact nations' recent gains in conventional military equipment are a major force motivating NATO's current drive to upgrade its ground combat materiel. The result of continuing Pact improvements is a gap in military power that NATO modernization efforts now just taking shape are designed to close. ^{1/} This chapter therefore gives an overview of the status quo, focusing on

- o Recent and ongoing Pact achievements,
- o The responses of the NATO members, especially as manifested in national commitments to defense spending, and
- o The United States' response in particular, as articulated in the Reagan Administration's modernization program for the Army.

Because the U.S. role in the defense of NATO remains large despite concerns in other parts of the globe and despite efforts on the part of the allies to shoulder a larger part of the burden than they have in the past, this chapter details systems comprised in the Administration's initiative, their combat capabilities, and their costs.

WARSAW PACT FORCE MODERNIZATION

If the Warsaw Pact nations continue to produce equipment at the rapid rates that have been observed in recent years, the majority of the existing forces that could confront NATO will be modernized by the late 1980s. In fact, in almost every major category of conventional weaponry, U.S. Army managers believe that the Soviet Union has already fielded a system that is qualitatively superior to its present U.S. counterpart. For example, not only has the Pact already fielded more than 7,000 new T-64 and T-72 tanks in the Central Region in the past five years; it also is

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1. In part, this is a result of fundamental differences in each side's approach to equipment modernization. The Soviet Union has demonstrated a preference for the introduction at regular intervals of new equipment that incorporates relatively minor changes. The United States, on the other hand, devotes a significant amount of time in the research and development phase in order to field new equipment incorporating major technological advances.

developing the T-80 tank, which military analysts regard as having better speed and armor than the current T-64 and T-72 tanks and is thought to be the equal to the United States' counterpart, the M1 tank (see the glossary in Chapter I for details on these systems). Included also in the Pact's inventory are an armored fighting vehicle (the BMP), which is equipped with a 73-millimeter automatic-loaded gun and an attack helicopter (the HIND), which is reported to carry four laser-homing tube-launched antitank missiles with an estimated range of eight kilometers. ^{2/} The one category in which parity is considered to exist is the field artillery cannon. ^{3/}

Table 1 shows the procurement ("buy") rates for the Pact weapons assumed in this study and the percentage of NATO-oriented forces that could be modernized through 1987 at these rates. The percentages assume that all modernization is focused on the 120 Warsaw Pact divisions that might be devoted to a NATO conflict. This modernization could increase the capability, measured in terms of firepower, of the NATO-oriented portion of the Pact forces by approximately 26 percent over the 1980 level. ^{4/} (Appendix B provides the details of this analysis.)

Not only have Pact nations been modernizing their equipment. The Soviets in particular have been expanding their combat forces in both tanks and artillery. Recent reports indicate that the Soviets have added an artillery battalion to the tank regiments of both tank and motorized rifle divisions, have added tanks to the reconnaissance battalions, and have expanded the motorized rifle companies to battalion-sized units within tank regiments of tank divisions. When complete, these changes will add more than 1,000 artillery pieces and more than 1,200 tanks and armored personnel carriers to the Soviet forces stationed in Europe. ^{5/}

2. See Jane's All the World's Aircraft 1978-79, pp. 190-192.

3. See Department of Defense Authorization for Appropriations for Fiscal Year 1982, Hearings Before the Senate Committee on Armed Services, 97th Congress, First Session, p. 1,180.

4. As used here, "firepower" means the ability to deliver heavy ordnance and explosives on enemy forces. The firepower assets examined in this study include tanks, armored fighting vehicles, artillery, antitank guided weapons (ATGW), and attack helicopters.

5. See U.S. Department of Defense, Soviet Military Power (1981), p. 30, and Richard Burt, "Soviets Said to Add to Its Bloc Troops," New York Times (June 8, 1980).

TABLE 1. PERCENTAGE OF WARSAW PACT FORCES MODERNIZED THROUGH 1987

Category of Weapons	Recent Annual Production Rates	Percent
Tanks <u>a/</u>	3,260	74
Armored Personnel Carriers	2,500	59
Artillery (Self-Propelled)	700	38
Attack Helicopters	180	610 <u>b/</u>

SOURCES: Compiled by CBO from various sources, including U.S. Department of Defense, Soviet Military Power (Fall 1981), pp. 12-13; Jane's All the World's Aircraft, 1980-81, pp. 202-203; Jane's Armor and Artillery, 1981-1982, pp. 403-405.

NOTE: This table assumes that the Warsaw Pact is adding force structure as well as modernizing such equipment as tanks and attack helicopters. The analytical baseline force is the 1976 structure.

- a. Includes T-72 and some T-80 tanks by 1987 funded delivery period.
- b. The Pact has made major additions to its attack helicopter fleet. In 1976, the Pact maintained approximately 300 attack helicopters in its inventory. By 1987, its inventory should exceed 2,200 helicopters, assuming that it can continue to produce roughly 15 HIND helicopters a month.

MODERNIZATION OF NON-U.S. NATO FORCES

Awareness of the Pact's growing ground force advantage prompted the NATO allies to adopt the Long-Term Defense Program in 1978. Under the program, all the NATO allies have committed themselves to working toward an alliance-wide force improvement. Each nation has pledged to try to meet a goal of real annual growth in defense spending of 3 percent. Within NATO, the United States devotes the largest share of its Gross National Product (GNP) to defense spending. Even taking account of the uncertainties in estimating the Soviet Union's defense expenditures, its share of GNP devoted to defense still exceeds that of the United States.

The European NATO members' success in meeting the 3 percent real growth goal has thus far been uneven. Recent economic difficulties have diminished the chances of many nations' achieving the target by 1983; to date, most of the European allies have fallen short of this objective (see Table 2). At the same time, however, the United States' growing concern with non-NATO interests--mainly Middle Eastern--has made the other allies' role in defending NATO increasingly important.

TABLE 2. COMPARISONS OF RECENT DEFENSE EXPENDITURES OF NATO MEMBER NATIONS: 1980-1981

Country	Defense Spending as a Percent of GNP in 1981	Real Growth in Defense Spending 1980-1981 (Percent Change)
Belgium	3.3	0.2
Canada	1.7	3.0
Denmark	2.5	0.1
Federal Republic of Germany	4.3 <u>a/</u>	1.9 to 3.4 <u>b/</u>
France	4.1	3.5
Great Britain	5.4	2.1
Greece	5.7	5.6
Italy	2.5	-1.2
Luxembourg	1.2	7.1
Netherlands	3.4	2.3 to 3.4 <u>b/</u>
Norway	3.3	2.5
Portugal	3.8	2.8
Spain	1.9	<u>c/</u>
Turkey	4.5	3.1
United States	6.1	5.4

SOURCES: Compiled by CBO from data in International Institute of Strategic Studies, The Military Balance 1982-83; and U.S. Department of Defense, Report on Allied Contributions to the Common Defense (March 1982), p. 77.

- a. Includes expenditures in West Berlin.
- b. A range is provided to accommodate two sets of deflators. The lower number assumes the use of a Defense Department estimate; the higher number assumes the use of the country's economic deflator.
- c. Spain joined the NATO alliance in May 1982 and has not therefore established a record for fiscal commitment to NATO's defense.

As part of the concerted effort to strengthen NATO's defense, each of the allies has announced equipment modernization programs for their ground forces. Over the next five years, the progress will probably be mixed. The West German and Dutch efforts will enhance armor and anti-armor capabilities. Britain's program is aimed at that nation's major weaknesses--tanks and artillery. The Belgians, on the other hand, will modernize only their fleet of armored personnel carriers. (Appendix C reviews briefly some of the current non-U.S. NATO conventional capabilities and the announced modernization programs.)

From a NATO perspective, the modernization efforts of the West Germans are most significant, since they could contribute up to 50 percent of the non-U.S. NATO forces available. Relative to the republic's 1980 force, modernization will yield an increased capability of almost 25 percent by 1987.^{6/} Most of the improvement in West German firepower is derived from the fielding of the Leopard II tank, which is armed with a 120-millimeter smooth-bore gun. Assuming that the current West German program is fully implemented, approximately 76 percent of all armored battalions will be equipped with the Leopard II by 1987.^{7/} In addition, the force is to be improved by procurement of the FH-70 155-millimeter towed howitzer, purchase of additional PAH (Panzerabwehr Hubschrauber 2) antitank helicopters, and the refitting with HOT (Haut Subsonique Optiquement Teleguide Tire d'Un Tube) missiles of most of vehicle-mounted antitank weapons systems.

Despite improvements in certain areas and dedicated efforts to increase defense spending as a share of the allies' GNP, however, a large part of the responsibility for NATO's defense will continue to rest with the U.S. Army. In fact, many proponents of the Administration's plan point to it as possibly giving an incentive to other member nations to boost their commitments to the NATO alliance.

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6. This estimate is based on the same methodology used to quantify the improvements to U.S. forces: measuring the change in effectiveness as a result of performance characteristics within each weapons category and the quantity to be fielded. See Appendix B for details.
 7. For fiscal year 1982, no real growth was programmed for the West German military budget. A report published by the West German defense ministry stated that "real growth rates for the defense budget are not to be expected and that some weapons programs will not be carried out." See John Vinocur, "Study by Bonn Foresees Trouble for the Military," New York Times (February 9, 1982), p. 12.

U.S. ARMY MODERNIZATION

The present Administration has proposed, in its February 1982 budget submission, to procure sizable numbers of new armor and anti-armor systems and to proceed with certain other new weapons already under development. Six specific systems (listed below, with numbers of units to be procured by the end of 1987) are considered in this study:

- o M1 Tank--6,729
- o M2 Fighting Vehicle System (FVS)--4,997
- o Multiple Launch Rocket System (MLRS)--333
- o Apache Attack Helicopter (AH-64)--446
to be equipped with the Hellfire Missile--29,756
- o Division Air Defense (DIVAD) gun--618
- o Army Helicopter Improvement Program (AHIP)--208

In some cases, new systems will replace existing ones; in others, they will provide totally new capabilities. ^{8/} Table 3 displays the rates at which these systems are to be purchased. The following informal table displays the percentages of Army assets to be modernized by 1987.

<u>Force or fleet</u>	<u>Weapons System</u>	<u>Percentage of Force Modernized by 1987 ^{a/}</u>
Tanks	M1 Tank	96
Armored personnel carriers	FVS	63
Artillery rocket systems	MLRS ^{b/}	100
Attack helicopters	AH-64	37
Air defense guns	DIVAD gun	100
Scout helicopters	AHIP	36

- a. Requirements assume 15 active divisions configured with Division 86 Table of Organization and Equipment (TO&E), training base, maintenance float, war reserve stocks, and four division sets in POMCUS (see also Appendix D).
- b. The MLRS will represent only 7 percent of the total artillery assets by 1987.

8. The Army will also modernize many other systems including nuclear (the Pershing II missile) and air defense systems (the Patriot missile system). The program is also to acquire various smaller weapons and support equipment.

TABLE 3. WEAPONS SYSTEMS PROCUREMENT PROFILES: 1979-1987

System	1979	1980	1981	1982	1983	1984	1985	1986	1987	Total
M1 Tank	90	309	569	665	776	1,080	1,080	1,080	1,080	6,729
FVS	--	100	400	600	600	555	775	1,009	958	4,997
MLRS	--	12	32	68	72	76	44	29	--	333
AH-64	--	--	--	11	48	96	125	140	26	446
Hellfire Missile	--	--	--	680	3,971	6,218	5,683	6,853	6,351	29,756
DIVAD Gun	--	--	--	50	96	130	132	144	66	618
AHIP	--	--	--	--	--	16	44	56	92	208

SOURCE: Compiled by the Congressional Budget Office from various sources, including data in Department of the Army, "Congressional Data Sheets In Support of the FY 1983 President's Budget" (February 1982).

The two new division sets the Administration has designated to augment the POMCUS program would receive some modernizations, since the U.S.-based units would draw upon the POMCUS equipment to fight a war.

The M1 Tank

A subject of heated controversy in 1980 and 1981, the M1 tank was finally approved for full-scale production in November 1981. The M1's reliability in early tests has been criticized in some circles. As late as December of the same year, the General Accounting Office, for example, recommended that the Congress delay large-scale production of the tank until the M1's power train (that is, the turbine engine, transmission, and final drive) could be made more durable.^{9/} Nonetheless, the Congress has supported continuing production and the Army plans substantial buys of the new tank--6,729 in total by the end of 1987.

9. For a detailed review, see General Accounting Office, "Large-Scale Production of the M1 Tank Should be Delayed until its Power Train is Made More Durable," MASAD 82-7 (December 15, 1981), and "Budgetary Pressures Created by the Army's Plan to Procure New Major Weapon Systems are Just Beginning," MASAD 82-5 (October 20, 1981). See also Congressional Budget Office, Reducing the Federal Deficit: Strategies and Options--A Report to the Senate and House Committees on the Budget, Part III (February 1982), pp. 43-46.

Army managers see the M1 as offering significant advantages over the current M-60 tank and as a good match for the highly sophisticated Soviet T-80 now being developed. Improvements to the main gun and fire control system would allow a four-man crew to fire with high accuracy while the tank is either stationary or moving, at greater ranges, and at night. Current plans assume incorporation of the West German 120-millimeter gun in the mid-1980s; this should enable the tank to penetrate any armor known thus far. Greater cross-country speeds will make the tank more agile and less vulnerable. Arrayed armor (called "Chobham type") and a lower silhouette will also decrease vulnerability, particularly to high-explosive shaped-charge munitions. ^{10/}

The M1's added capability will not, however, be cheap: the M1 tanks purchased in 1983 and beyond will cost \$2.8 million apiece. The total program is estimated to cost \$19.5 billion. When all 6,729 M1s are delivered, about 96 percent of the Army's force (that is, the active units, associated reserve units, training base, maintenance float, POMCUS stocks, and war reserves) will have been equipped with the M1 tank.

The Fighting Vehicle System

The FVS, an armored personnel carrier designed to operate with the M1 tank, offers major advantages over the current M113, which has little striking power. With a 25-millimeter cannon and Tube-launched, Optically-tracked, Wire-guided (TOW) antitank missiles (see glossary), the FVS will allow infantry troops to fight from within the vehicle and provide greater fire support for dismounted operations in either daylight or at night. The fielding of nearly 5,000 of these vehicles will increase by 180 percent the number of TOW antitank missile launchers in the Army's armored and mechanized infantry divisions. ^{11/} Furthermore, the vehicle's better cross-country speed and armor protection provide greater mobility and ability to survive attack ("survivability").

Total program acquisition unit costs for the FVS are currently estimated at \$1.9 million; the full purchase could total \$13.4 billion. Roughly 63 percent of the force will be modernized with the FVS when all of the vehicles procured through 1987 are delivered.

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10. As compared to a munition that pierces through armor, a shaped-charge munition penetrates an object by concentrating its energy in a specific direction and burning through the shell with a gaseous mass.
 11. See Department of the Army, The Posture of the Army and the Department of the Army Budget Estimates for Fiscal Year 1983, p. 21.

Multiple Launch Rocket System

Fielding the MLRS will give the United States a new counterfire capability that the Soviets already possess. (Counterfire, or counter-battery, is the ability to fire upon the enemy's artillery.) This system will not replace any current artillery pieces; instead, it will complement cannon artillery. Its greatest advantage is the ability to fire massive quantities of munitions very quickly. Compared with the standard eight-inch self-propelled artillery, the MLRS can increase firepower by a factor of 12. It can launch 12 unguided rockets in less than 60 seconds to ranges greater than 30 kilometers.

At \$12.1 million per unit, the total procurement of 333 MLRS units is estimated at \$4.1 billion. When all of these systems are delivered, 100 percent of the requirement for MLRS in the active force will be satisfied. ^{12/}

Apache Attack Helicopter (AH-64) and Hellfire Missile

Equipped with the 16 Hellfire missiles, the AH-64 will provide significant improvements over the current fleet of Cobra helicopters armed with eight TOW missiles. The attack helicopter is charged with disrupting and destroying enemy armor, and the Cobra helicopter must expose itself long enough--usually 30 seconds--to guide the missile to its target. In addition to the all-weather capability of the AH-64, the principal advantage of this system is its increased survivability: the aircraft need not be exposed in order to launch its anti-tank missiles. Once a target is identified (either by ground observer or by other helicopters), the Hellfire missile "homes in" on the designated target. Plans include the future development of a "fire and forget" version of the Hellfire missile; once fired, the missile will not need any external target designation.

This added capability will be costly, however. The program acquisition unit cost for the helicopter alone is estimated at \$16 million, for a total outlay of \$7.4 billion for the full 446 units to be bought. When all are delivered, roughly 37 percent of the Army's attack helicopter fleet will be modernized.

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12. Other U.S. modernization programs for artillery are in the area of improved conventional munitions (ICM). Increasing the effectiveness of current artillery assets, these munitions will provide a greater anti-tank capability.

Army Helicopter Improvement Program

The AHIP is designed to provide a more capable scout helicopter by the mid-1980s by modifying the existing OH58 helicopter. ^{13/} As an unarmed helicopter, its primary mission is to locate targets and to serve as an aerial designator for attack helicopters and artillery. Relative to the current scout helicopter, the AHIP, by means of a mast-mounted sight and a four-blade rotor, improves the ability to find targets at night and in heavy weather. ^{14/} No improvements for the airframe are planned, however.

Though the modification program would improve the OH58 helicopter, it is considered only an interim solution for the scout mission. The Army is now developing a new fleet of helicopters to perform the scout/observation mission that would complement the new AH-64 and Blackhawk transport helicopters. ^{15/} Thus, under AHIP, the Army could

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13. To meet the requirements for the scout helicopter, the Army originally proposed the procurement of a new helicopter in the mid-1970s. In November 1979, the Army System Acquisition Review Council (ASARC) concluded that the Advanced Scout Helicopter (ASH) was not affordable and directed a modification program. See Hearings on Military Posture, Department of Defense Authorization for Appropriations for Fiscal Year 1983 before the House of Representatives Committee on Armed Services, 97th Congress, Second Session, Part III, pp. 285-287.
 14. Improvement in the location of targets at night is a result of the incorporation of the mast-mounted sight, which contains a forward-looking infrared sensor and a laser rangefinder. Improvement in the helicopter's capability in Southwest Asia is achieved through the substitution of a four-blade main rotor for the existing two-blade main rotor, and improvements in the engine and transmission.
 15. The Army's fiscal year 1983 budget request for Research and Development contained about \$1 million for the development of a new light helicopter to perform scout/observation missions. In its first year of development, the Light Helicopter Advanced Technology Demonstrator (LHATD) program is designed to provide a helicopter that is lighter, uses less fuel, and reduces crew workload as compared with current fleets. See Department of Army, Fiscal Year 1983 Research, Development, Test, and Evaluation Congressional Descriptive Summary, pp. I425-428.

spend large sums to improve existing scout helicopters and by the early 1990s, could have a new model ready for procurement. Moreover, some of the target acquisition and designation mission could be met by the attendant capabilities of the new AH-64 and by use of the new Ground Laser Locator Designator (GLLD) designed for artillery. Both of these new systems are now in production, and each contains highly sophisticated target location capabilities.

Nonetheless, from 1984 to 1987, the Army plans to modify 208 of its fleet of OH58 helicopters. The unit cost is estimated at \$4.4 million, for a total of \$2.5 billion for the full complement of 578. Roughly 36 percent of the Army's scout helicopter force would be modernized by 1987.

The Division Air Defense Gun

The DIVAD gun is designed primarily to attack enemy helicopters and other low-altitude aircraft within an effective range of four kilometers. The DIVAD gun will replace the existing Vulcan 20-millimeter gun system, which has an effective range of two kilometers. It can also attack lightly armored vehicles and trucks. Mounted on a M48A5 tank chassis, this twin 40-millimeter gun system relies on a sophisticated F16 aircraft radar. The system has a rapid fire capability; after it identifies a target, the DIVAD gun can position and fire within ten seconds.

Though the DIVAD offers significant improvements over the current Vulcan air defense system, the latest version of the Soviet attack helicopter--the Hind E--may in fact have twice the effective range. Thus, were the Soviets to field the Hind E helicopters at rates consistent with recent experience, by the end of the 1980s, some 50 percent of the Pact helicopter fleet would have the capacity to fire its ordnance far beyond the range of the DIVAD gun. Further, the DIVAD's active radar (similar to that of the F16 aircraft), which gives the gun the ability to locate enemy targets at ranges of four kilometers, may also provide the enemy with a target on which to home in. This could increase the long-range vulnerability of the DIVAD system.

Despite these potential drawbacks, the Army plans to buy 618 DIVAD gun systems by 1987. The unit acquisition cost is estimated at \$6.8 million, and the total program cost is roughly \$4.2 billion. When all of these systems are fielded, the full requirement for the DIVAD gun will be satisfied.

CHAPTER III. THE EFFECTS OF MODERNIZATION ON FORCE RATIOS

The ultimate test of the balance of NATO and Warsaw Pact forces, of course, would be the outcome of a war. But the concept of deterrence, based on the premise that the balance of forces be such that war is a futile undertaking for either alliance, ought to obviate such a test. Indeed, the MBFR negotiations (see Chapter I), fruitless though they have been thus far, are motivated by a desire to maintain such a peacekeeping stalemate, but with a lesser investment of resources than either alliance is currently making. In light of the unproductiveness of the MBFR talks to date and the persistence of both sides in trying to improve the effectiveness of ground force materiel, however, an assessment of these efforts is warranted.

A judgment of the effectiveness of the proposed modernization efforts outlined in Chapter II must be drawn from purely hypothetical criteria. This chapter weighs the prospective force balance on the basis of an analytical tool called an Armored Division Equivalent (ADE), a device conceived and routinely used by the Defense Department. Details about how the ADE is constructed and what it measures are given below.

No theoretical gauge, no matter how carefully devised, however, can capture certain unquantifiable elements that could be decisively influential on the outcome of armed hostilities. Primary among these intangible factors are quality of leadership and tactics, personnel morale, and weather. The analysis that follows cannot take account of such factors. Reasonable estimates can only be made of the numerical and qualitative balance of military manpower and equipment on each side and the effects of modernization programs on this balance.

MEASURING THE FORCE BALANCE

The Armored Division Equivalent provides a measure of relative combat power over time. When this technique is used, each weapon is assigned a numerical value based on its technical capability and use in combat. The strength of a given combat unit is the sum of all the weapons available to it. That number is then divided by the equivalent score for a U.S. armored division in order to measure all units by a common denominator. As a method for assessing the current balance, CBO has updated an

earlier Department of Defense analysis based on ADEs. ^{1/} (Appendix B discusses this measure in more detail.)

To assess the balance of forces using ADE scores, this study makes numerous assumptions. The study concentrates on the balance of forces in Central Europe, since deterring, or if necessary winning, a conflict in Europe remains the U.S. Army's primary mission. The study also makes the assumption, standard in military planning, that NATO mobilizes four days after the Warsaw Pact, since NATO needs time to detect a Pact mobilization and make and implement a decision to mobilize.

The study also assumes that NATO would defend itself using 15 of the 16 active U.S. Army divisions, plus various reserve and other forces (the one division stationed in Korea is assumed unavailable). The allies would contribute some 32 active divisions plus various additional reinforcements. The Warsaw Pact is assumed to commit 120 divisions, each of which, however, would be numerically somewhat smaller than the typical NATO division. Since some 231 divisions are now available to the Pact, the study assumes that 111 Pact divisions would be allocated to the Chinese border, the northern and southern flanks of Europe, and to the strategic reserve. ^{2/} (The Defense Department often assumes that the Pact would confront NATO with only 90 divisions, despite the 231 divisions available; the effects of a 90-division threat are assessed below.)

Though useful, ADE scores have important limitations. They depend, of course, on the many difficult assumptions discussed above. Moreover, they require analysts to make uncertain judgments about the capabilities of each weapons system; those used in this study are discussed in Appendix B. The effects of tactical air power on the ground battle are not reflected in ADE scores, since both sides have substantial and perhaps offsetting tactical air capacity (see Appendix B). This may not, however, create any serious analytical distortion. Nor do ADE scores account for the effects of some major systems that the Army is buying, such as the AHIP scout helicopter and the Blackhawk transport helicopter. These limitations suggest that ADE scores should serve only as one guide to decisions that have to be made with other criteria in mind.

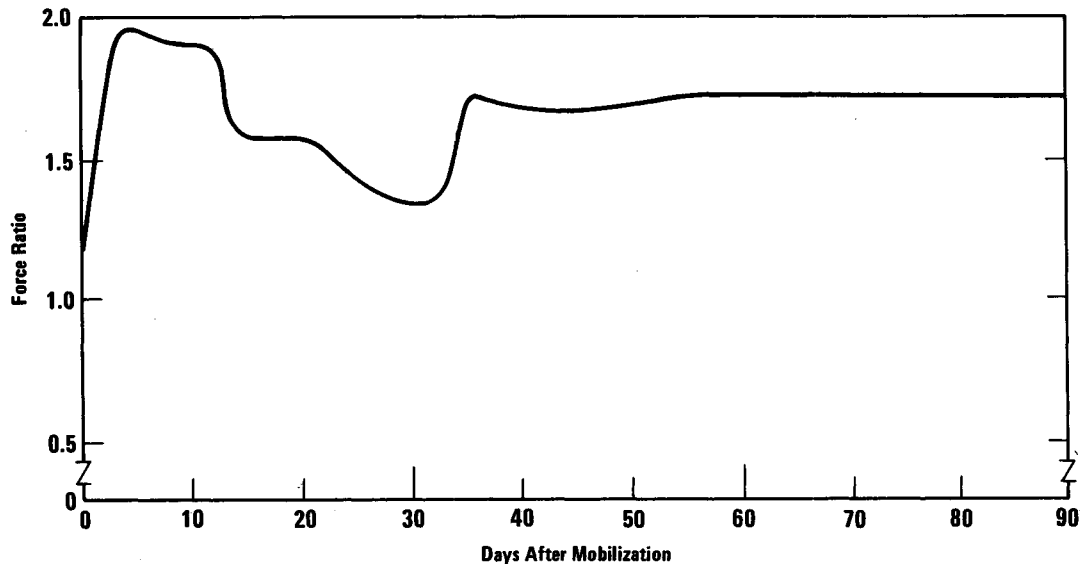
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1. See U.S. Department of Defense, A Report to Congress on U.S. Conventional Reinforcements for NATO (June 1976).
 2. The 24 divisions of the Bulgarian, Hungarian, and Romanian armies are not included in this total because it is assumed that they would be committed to any conflict in the southern flank.

BEFORE MODERNIZATION--THE FORCE BALANCE AS OF 1980

NATO's defensive military posture is based on the assumption that NATO maintains enough forces at the ready--both equipment and troops--to deter an attack by the Warsaw Pact. This posture has both military advantages and disadvantages. While the Pact can choose the time and location of an attack, NATO's advantage is the choice of local terrain where it can fight from prepared positions. On the other hand, NATO's disadvantage is that it does not have all its forces in Europe and must bring a full one-third of their reinforcements from the United States. Within ten days after mobilization, for example, the United States could deliver four reinforcing Army divisions, since their equipment is prepositioned in Europe as part of the POMCUS program. As NATO brings its reinforcements forward, however, the Pact could be adding divisions to the front.

Figure 2.

Shifting Warsaw Pact/NATO Force Balance in 1980:
90 Days Following Pact Mobilization



SOURCE: Congressional Budget Office.

Figure 2 depicts graphically the shifting balance, as of 1980, of Warsaw Pact to NATO forces during the first 90 days following a Pact mobilization. The latest year for which a detailed Defense Department analysis is publicly available is 1976. The CBO has updated the analysis to

reflect the accelerated deployment of U.S. divisions achieved by recent programs for the 1980s. ^{3/} The figure measures the balance in terms of a ratio of the ADE scores for all Pact forces in the European theater to the scores for all NATO forces. According to this measure, the ratio of Pact to NATO forces exceeds 1.5:1 for most of the first 20 days after mobilization. Only between 20 and 30 days after mobilization does the ratio appear to dip below 1.5:1.

Pact-to-NATO ratios above 1.5:1 in the entire European theater may, however, be regarded as too favorable to Pact forces to give NATO a good chance of a successful defense. (A "successful defense" is a situation in which NATO forces are able to lose little territory and not withdraw behind initial defense lines.) To maintain the continuity of NATO's defensive line, U.S. strategists believe they require a force that has enough divisions to cover the front while simultaneously maintaining an attacker-to-defender ratio of 3:1 or less in any area where the aggressor chooses to attack. Meeting this requirement could call for an attacker-to-defender ratio of no more than 1.5:1 over the entire European theater. This 1.5:1 ratio is also what the Defense Department regards as minimally acceptable. The Department has stated that "... certain ratios. . . should not be allowed to favor an attacker by too great a margin. For example, if an attacker could achieve a favorable overall ratio of perhaps 1.5:1 in several of these respects, he could embark on such large local concentrations that the defender would find it difficult to prevent one or more breakthroughs." ^{4/}

Thus the ratios suggest two periods when the Pact could have an advantage (see Figure 2). In the initial period following mobilization, the Pact advantage would result from NATO forces' needing time to move to and prepare their defensive positions. As reinforcements arrived from the United States, however, the early Pact advantage would begin to erode. But within approximately four weeks after mobilization, the Pact would recover its advantage as 30 more Pact divisions became available. The advantage would continue over the first three months after mobilization.

With this advantage, Pact forces could concentrate on a single NATO corps sector--resulting in a Pact/NATO force ratio of 6:1 in the main attack sector and as much as a 1:1 local force ratio in all other sectors. To respond to such an attack and lower the ratio at the primary sector to 3:1,

3. See Congressional Budget Office, U.S. Ground Forces: Design and Cost Alternatives for NATO and Non-NATO Contingencies (December 1980).

4. See U.S. Department of Defense, Annual Report, Fiscal Year 1976 and 1977, p. III-15.